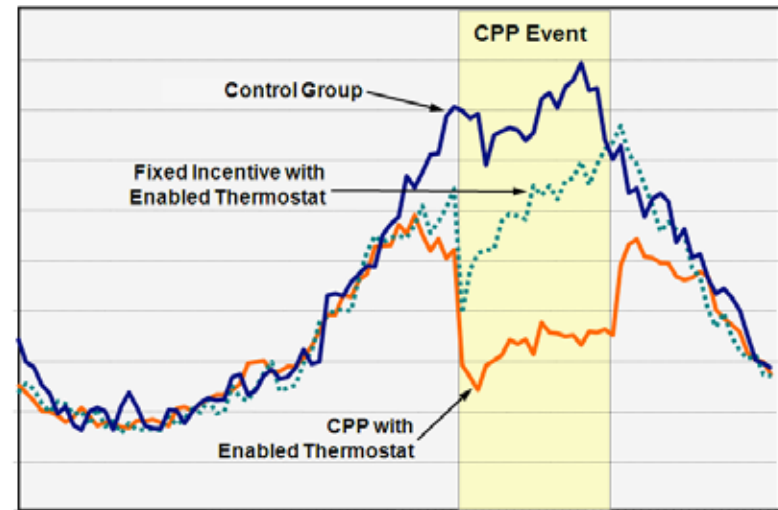
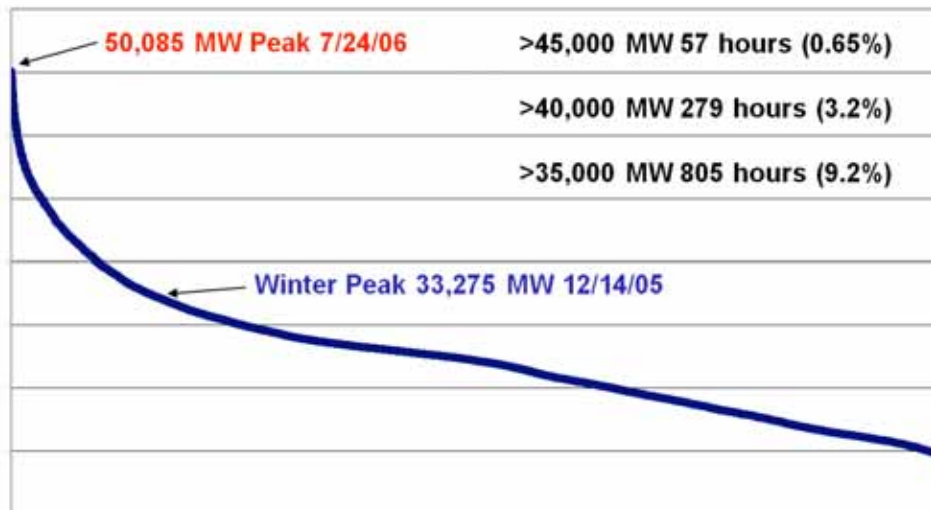


California Load Management Standards and How They are Expected to Spur Innovation

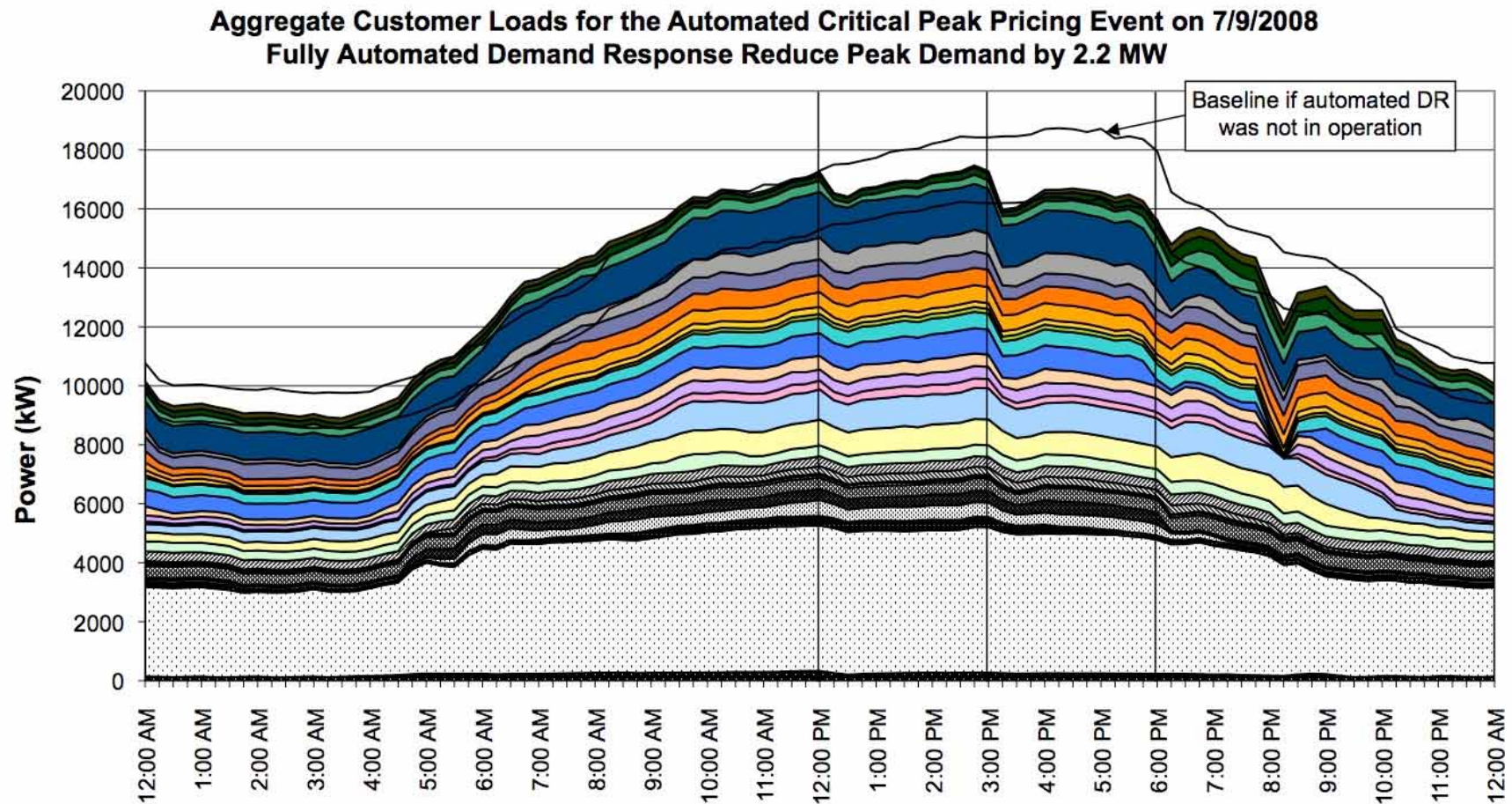
Commissioner Arthur H. Rosenfeld, Ph.D
California Energy Commission

Berkeley Wireless Research Center
Granlibakken, CA --- June 1, 2009



Demand Response Event on 7/9/2008

28 Sites Shed 2.2MW



Two Energy Agencies in California

- The California Public Utilities Commission (CPUC) was formed in 1890 to regulate natural monopolies, like railroads, and later electric and gas utilities.
- The California Energy Commission (CEC) was formed in 1974 to regulate the environmental side of energy production and use.
- Now the two agencies work very closely, particularly to delay climate change.
- The Investor-Owned Utilities, under the guidance of the CPUC, spend “Public Goods Charge” money (rate-payer money) to do everything they can that is cost effective to beat existing standards.
- The Publicly-Owned utilities (20% of the power), under loose supervision by the CEC, do the same.

California Energy Commission Responsibilities

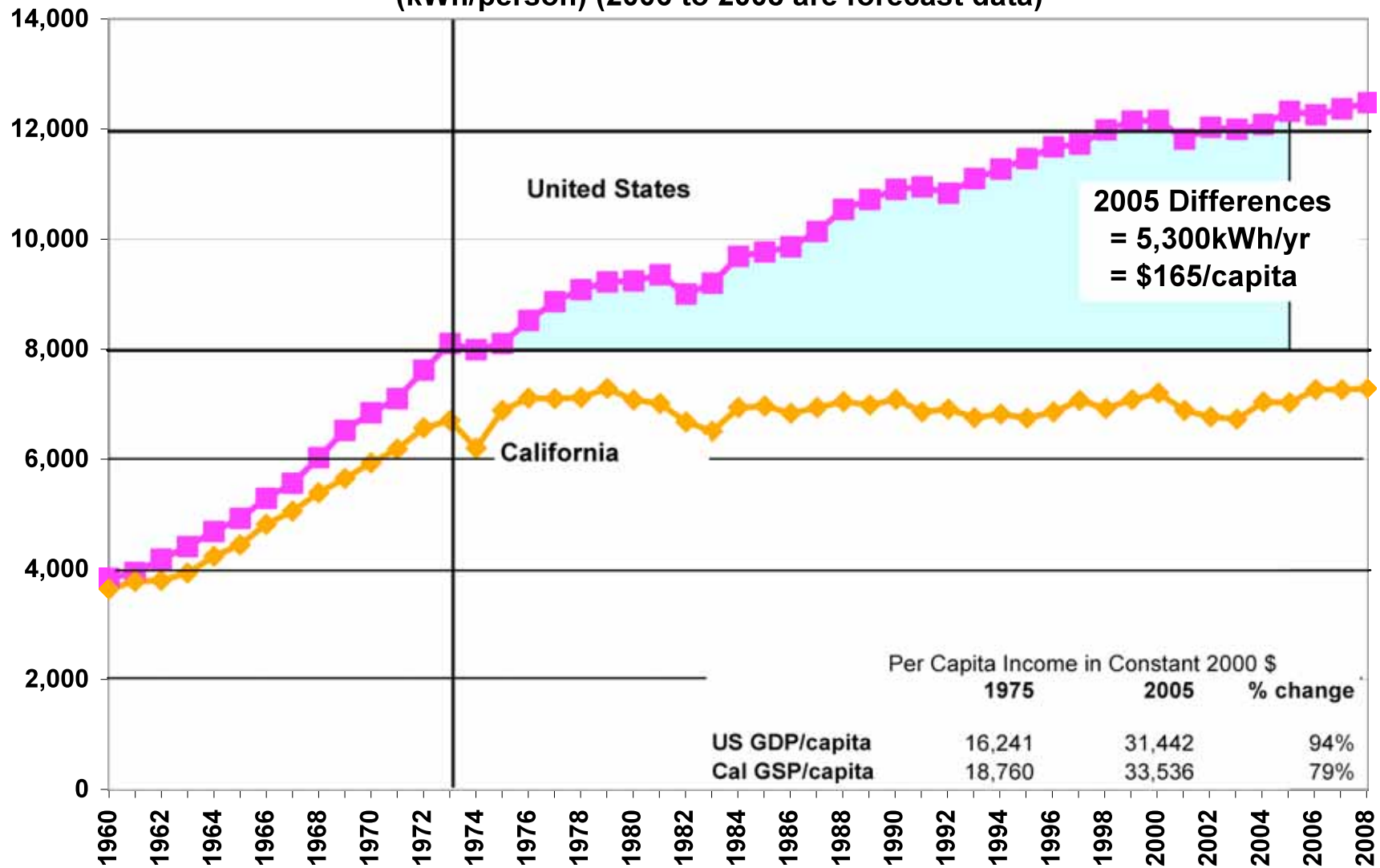
Both Regulation and R&D

- California Building and Appliance Standards
 - Started 1977
 - Updated every few years
- Siting Thermal Power Plants Larger than 50 MW
- Forecasting Supply and Demand (electricity and fuels)
- Research and Development
 - ~ \$80 million per year
- CPUC & CEC are collaborating to introduce communicating electric meters and thermostats that are programmable to respond to time-dependent electric tariffs.

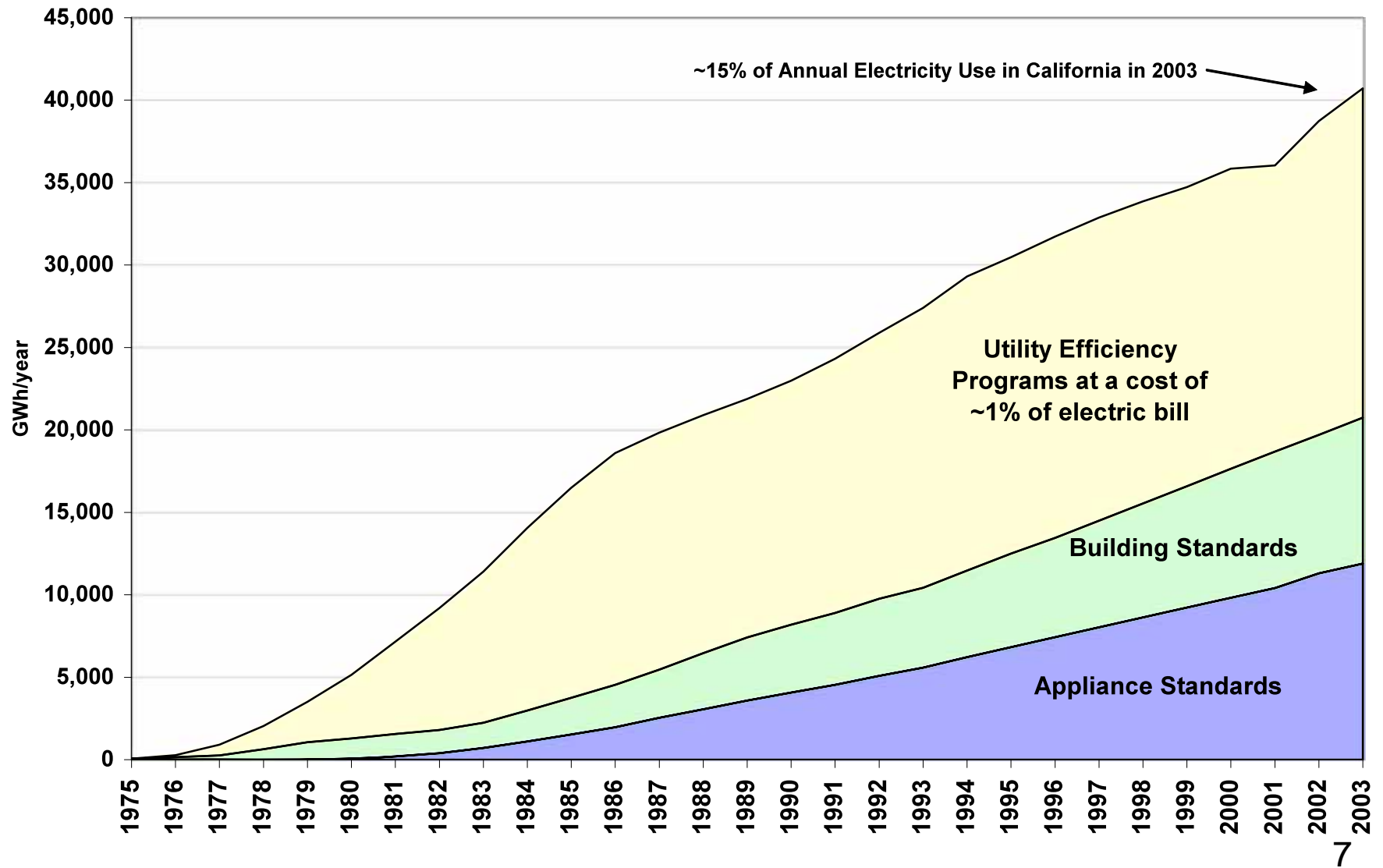
California's Energy Action Plan

- California's Energy Agencies first adopted an Energy Action Plan in 2003. Central to this is the State's preferred "Loading Order" for resource expansion.
 1. Energy efficiency and Demand Response
 2. Renewable Generation,
 3. Increased development of affordable & reliable conventional generation
 4. Transmission expansion to support all of California's energy goals.
- The Energy Action Plan has been updated since 2003 and provides overall policy direction to the various state agencies involved with the energy sectors

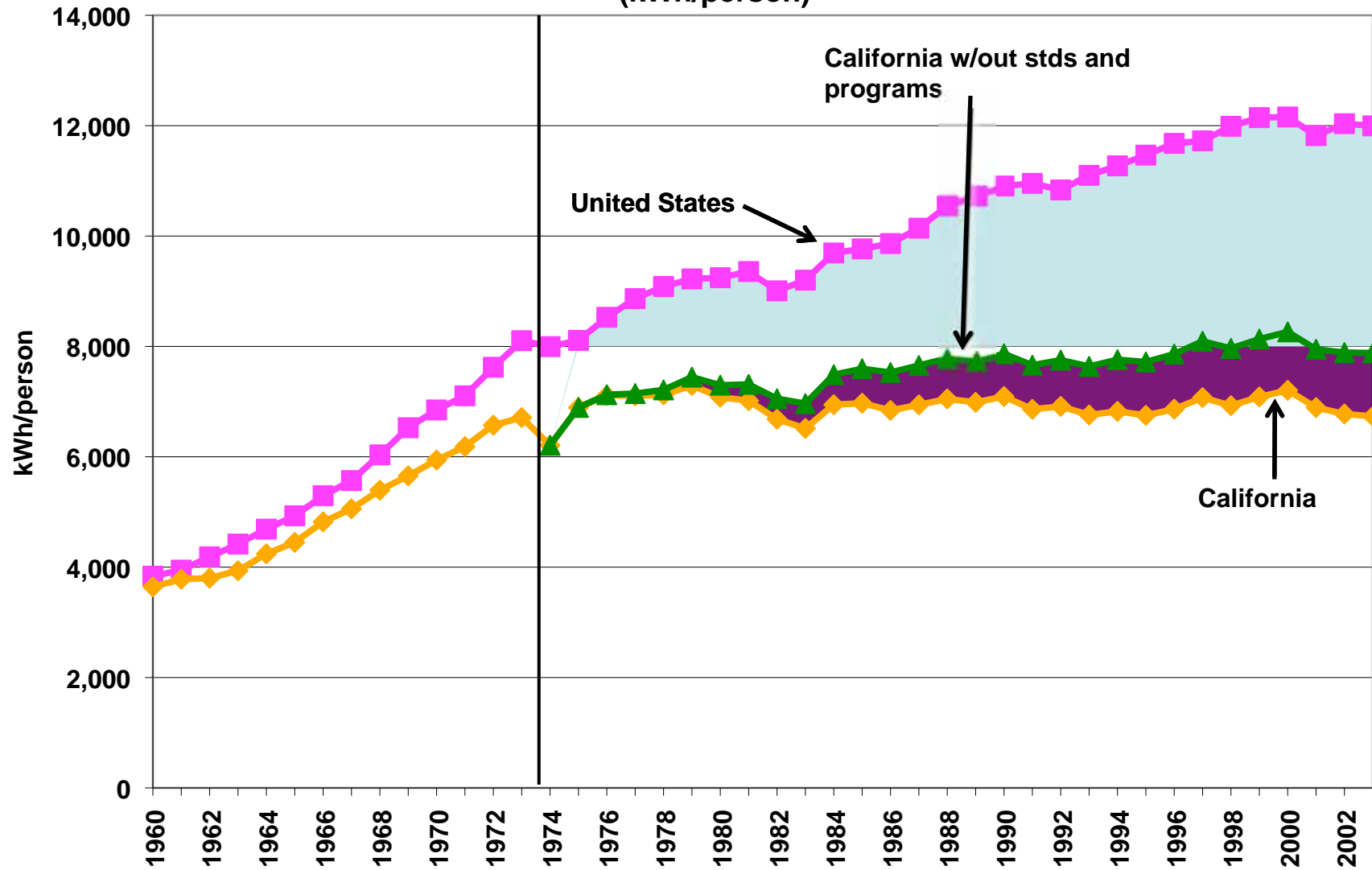
Per Capita Electricity Sales (not including self-generation)
(kWh/person) (2006 to 2008 are forecast data)



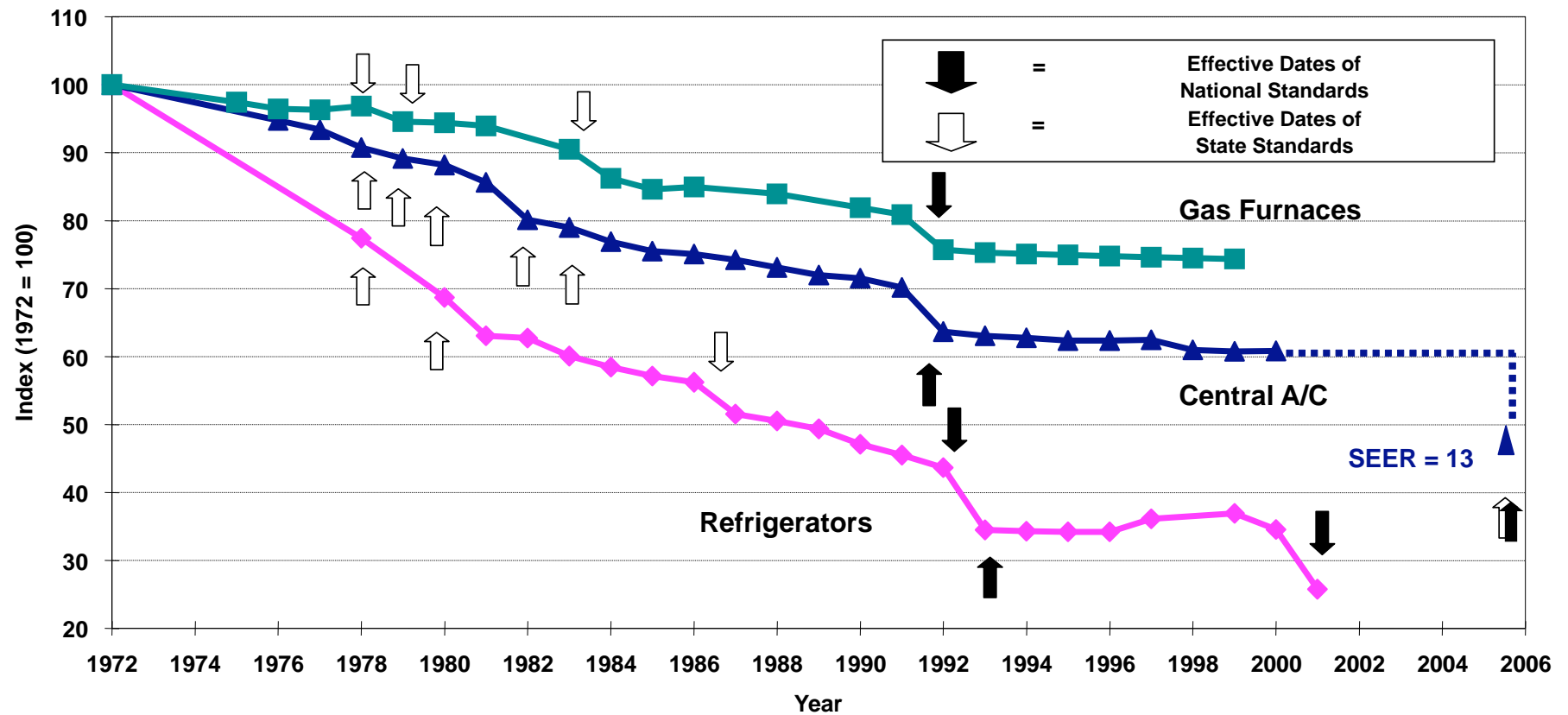
Annual Energy Savings from Efficiency Programs and Standards



**Per Capita Electricity Sales (not including self-generation)
(kWh/person)**

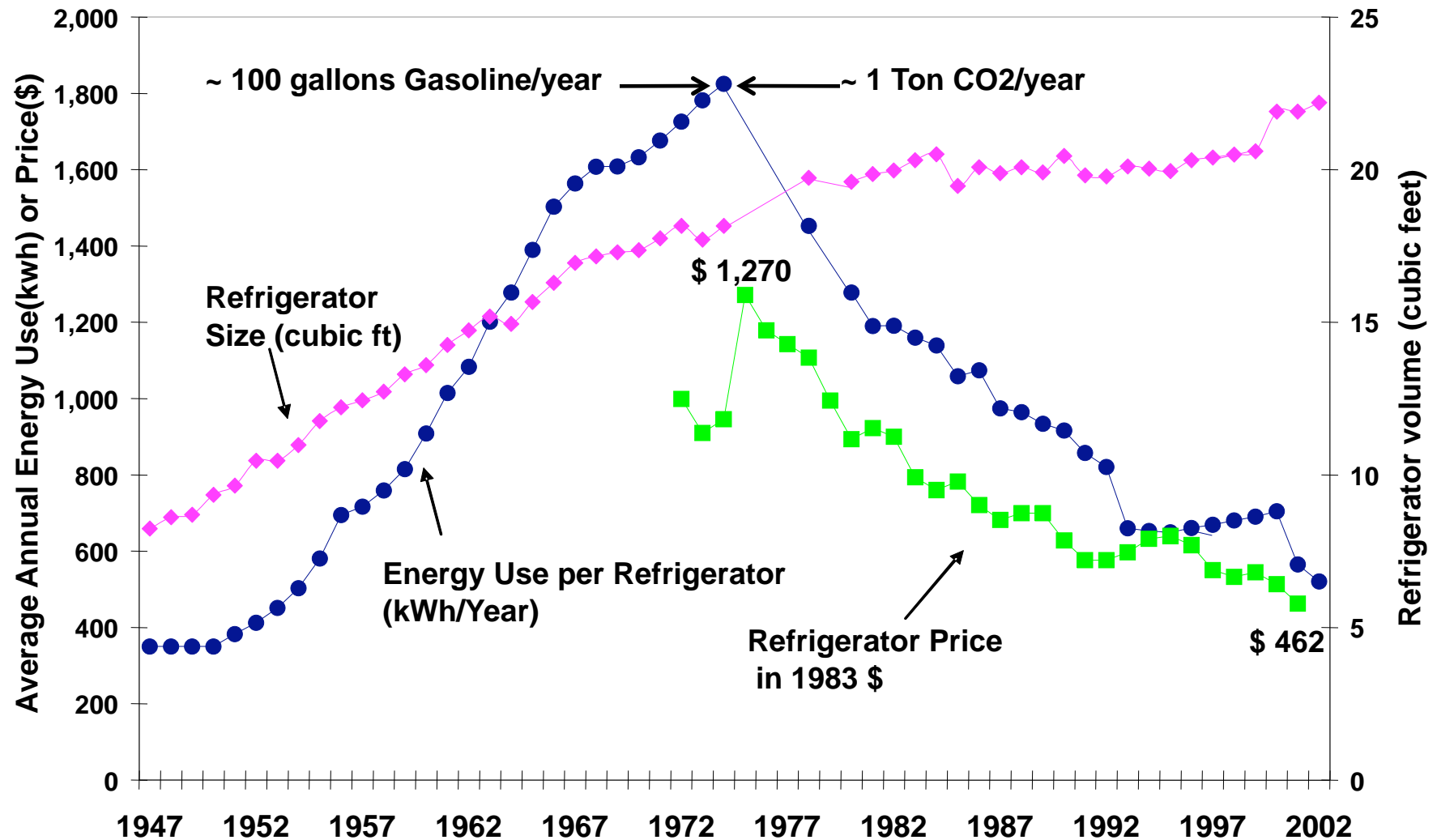


Impact of Standards on Efficiency of 3 Appliances



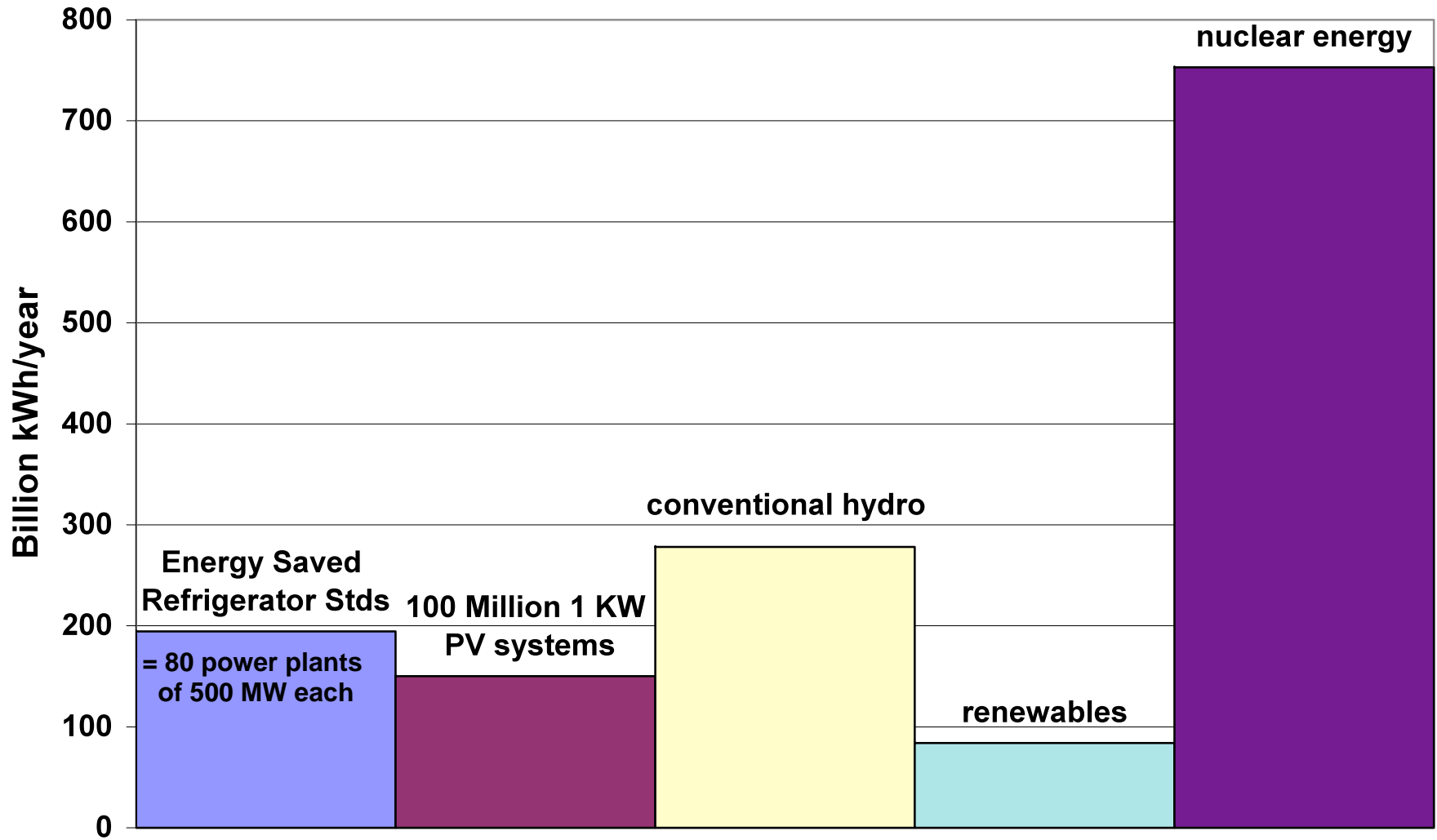
Source: S. Nadel, ACEEE,
in ECEEE 2003 Summer Study, www.eceee.org

New United States Refrigerator Use v. Time and Retail Prices

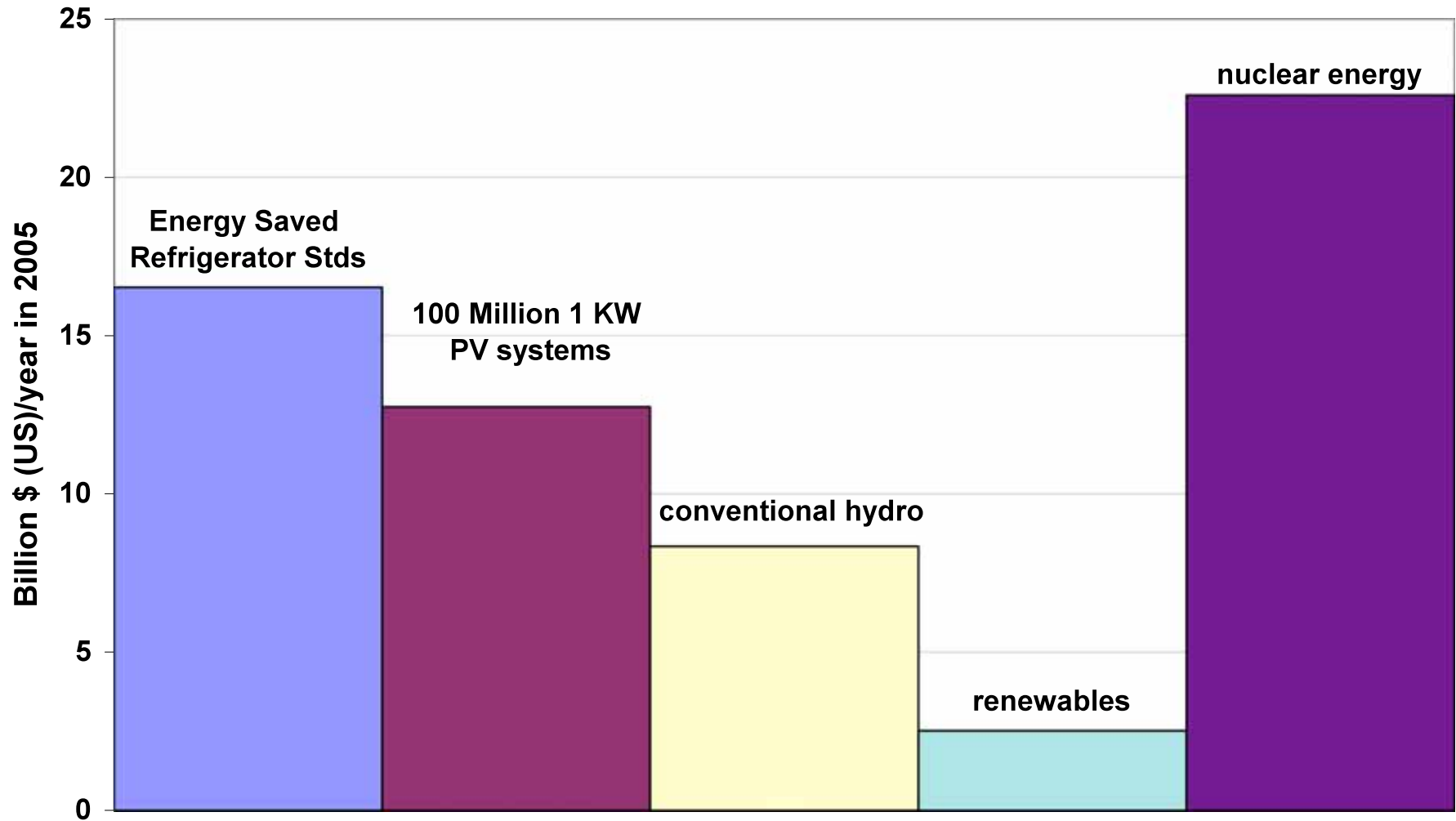


Source: David Goldstein

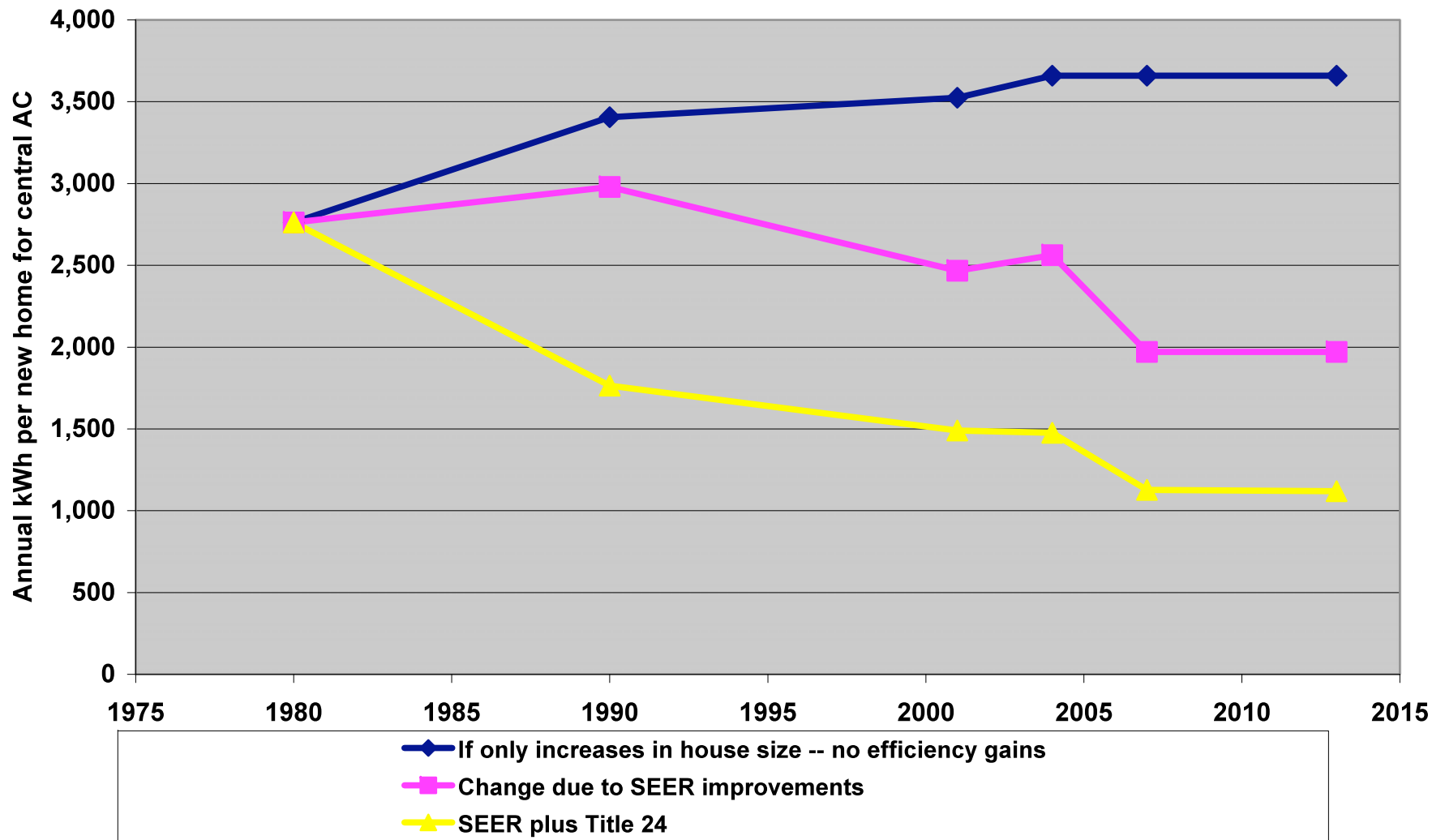
Annual Energy Saved vs. Several Sources of Supply In the United States



In the United States
Value of Energy to be Saved (at 8.5 cents/kWh, retail price) vs.
Several Sources of Supply in 2005 (at 3 cents/kWh, wholesale price)

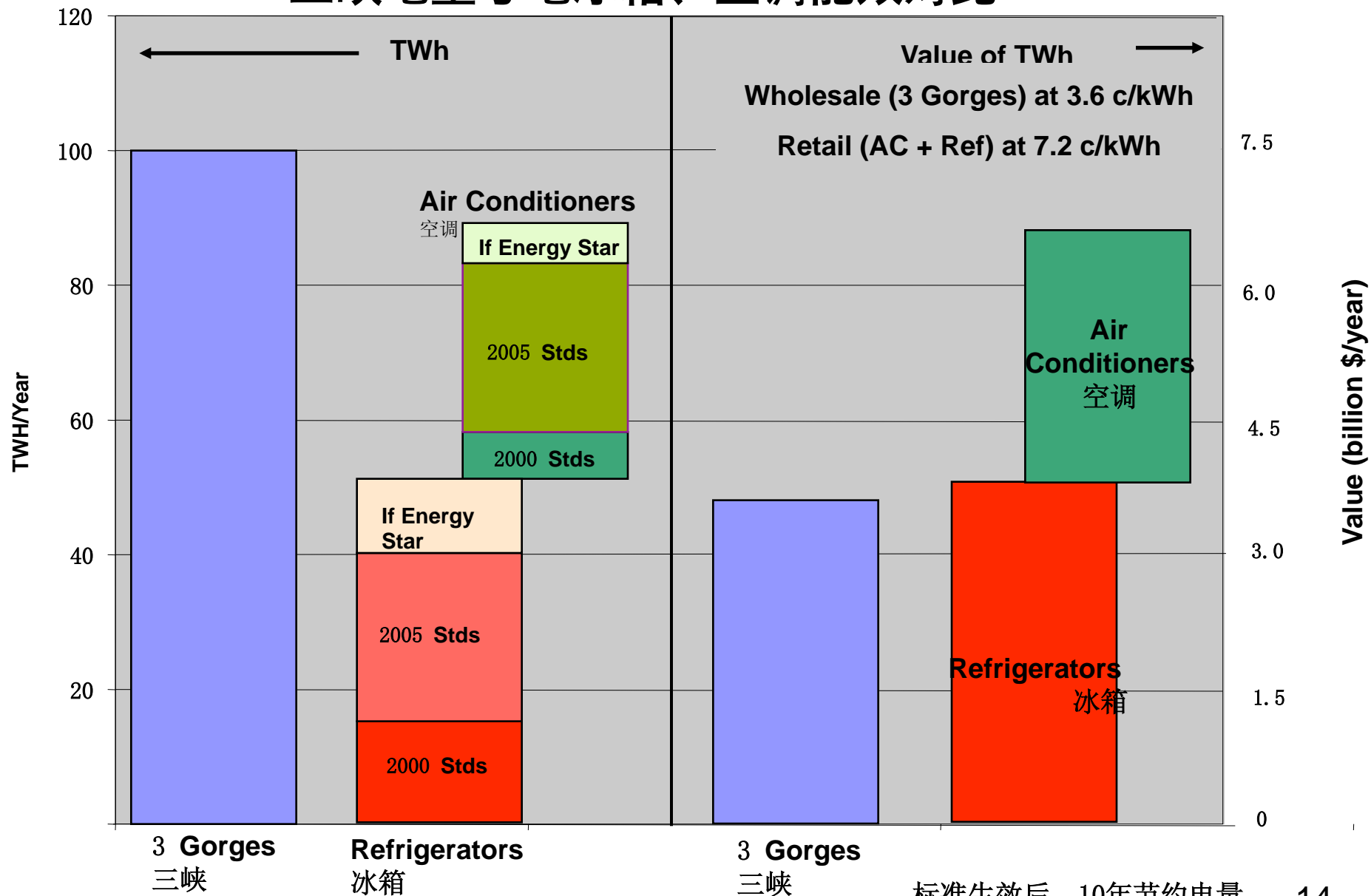


Air Conditioning Energy Use in Single Family Homes in PG&E The effect of AC Standards (SEER) and Title 24 standards



Comparison of 3 Gorges to Refrigerator and AC Efficiency Improvements

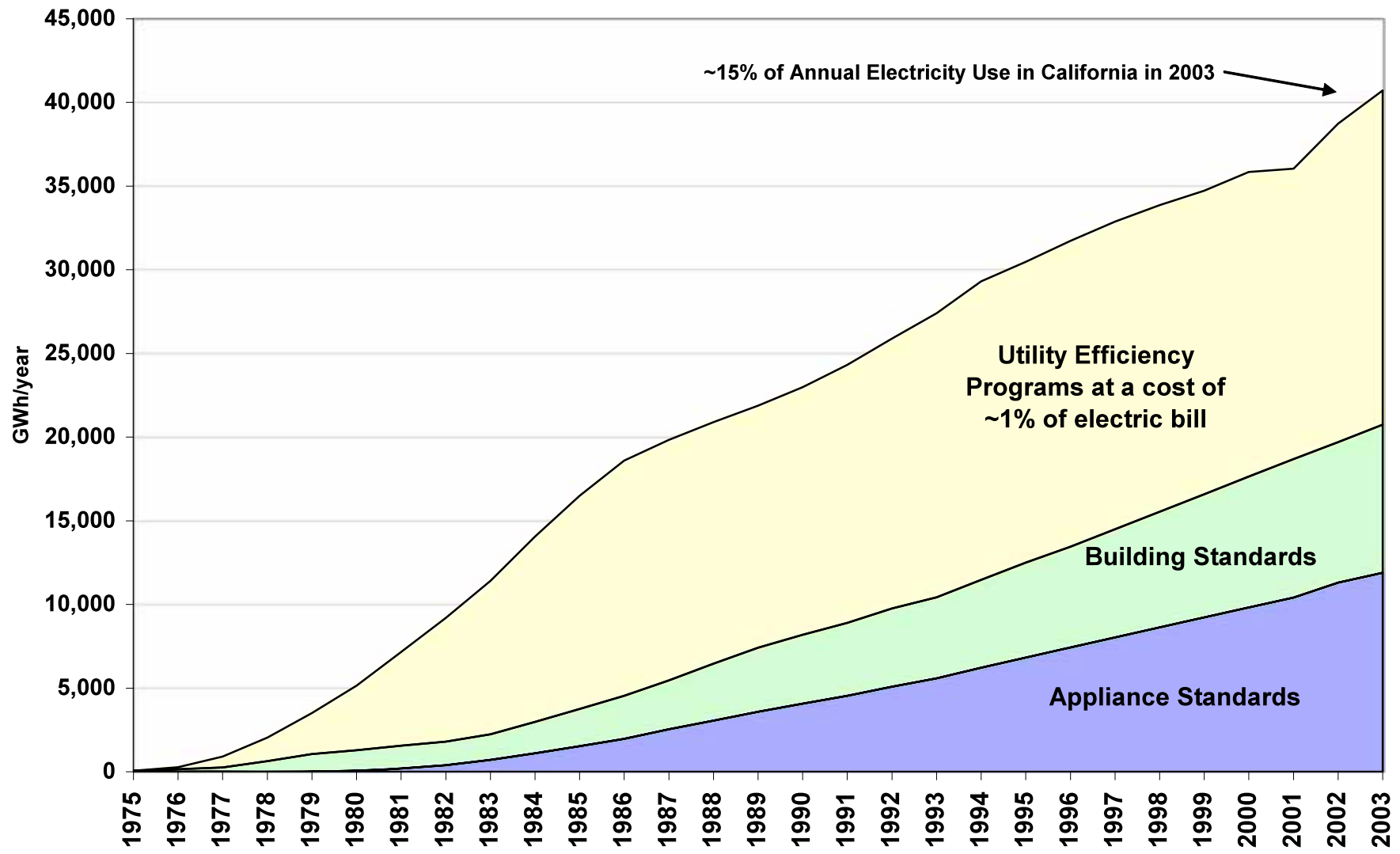
三峡电量与电冰箱、空调能效对比



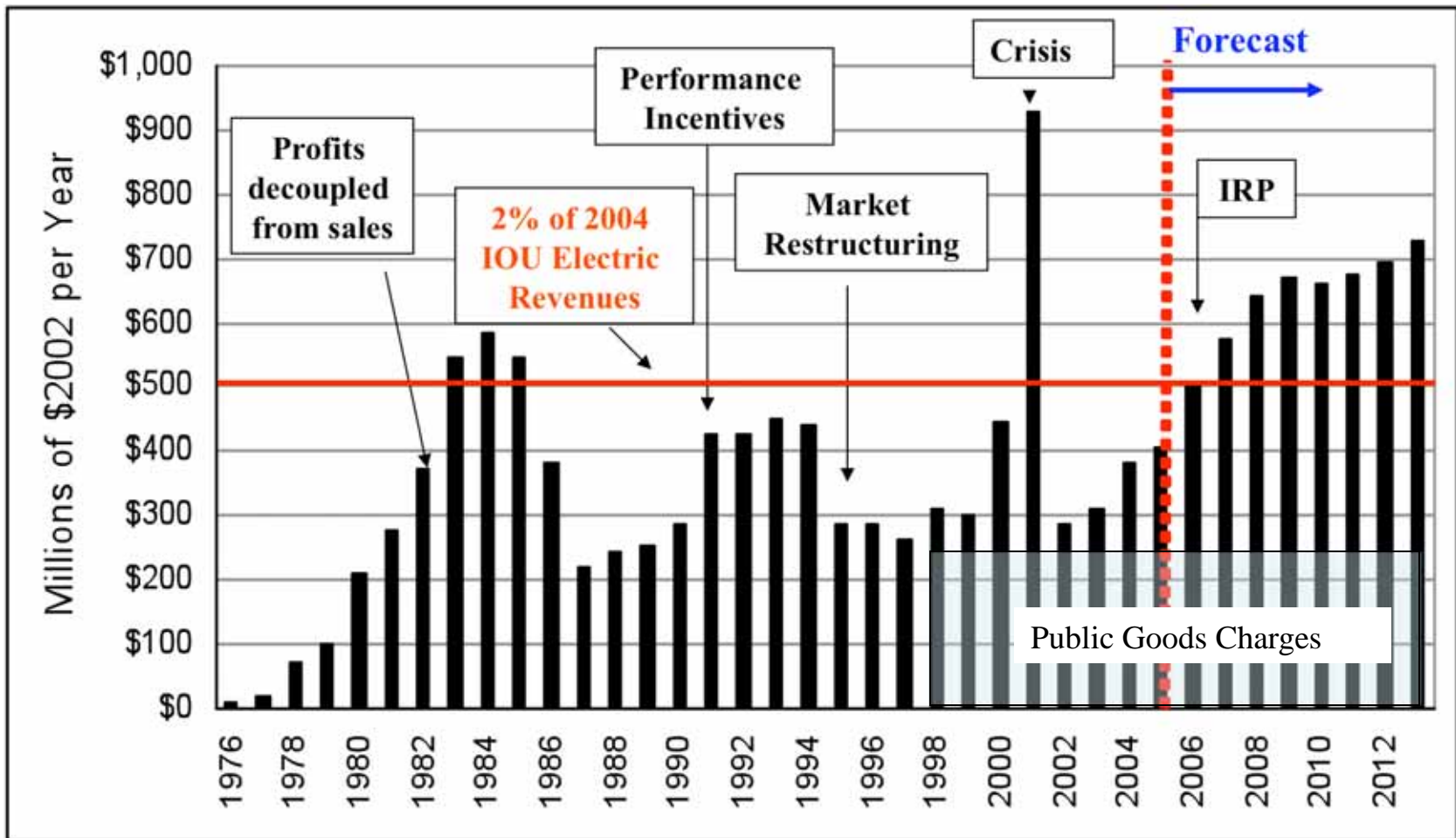
Savings calculated 10 years after standard takes effect. Calculations provided by David Fridley, LBNL

标准生效后，10年节约电量

Annual Energy Savings from Efficiency Programs and Standards



California IOU's Investment in Energy Efficiency



Demand Response

In 3 cool seasons CA peak is 40 GW, but a/c adds 20 GW in summer
So we want demand response to price.

So all customers will receive

- Communicating interval meters, 10 million of them

- Dynamic pricing: TOU summer afternoon + “critical peak” 10 days/yr

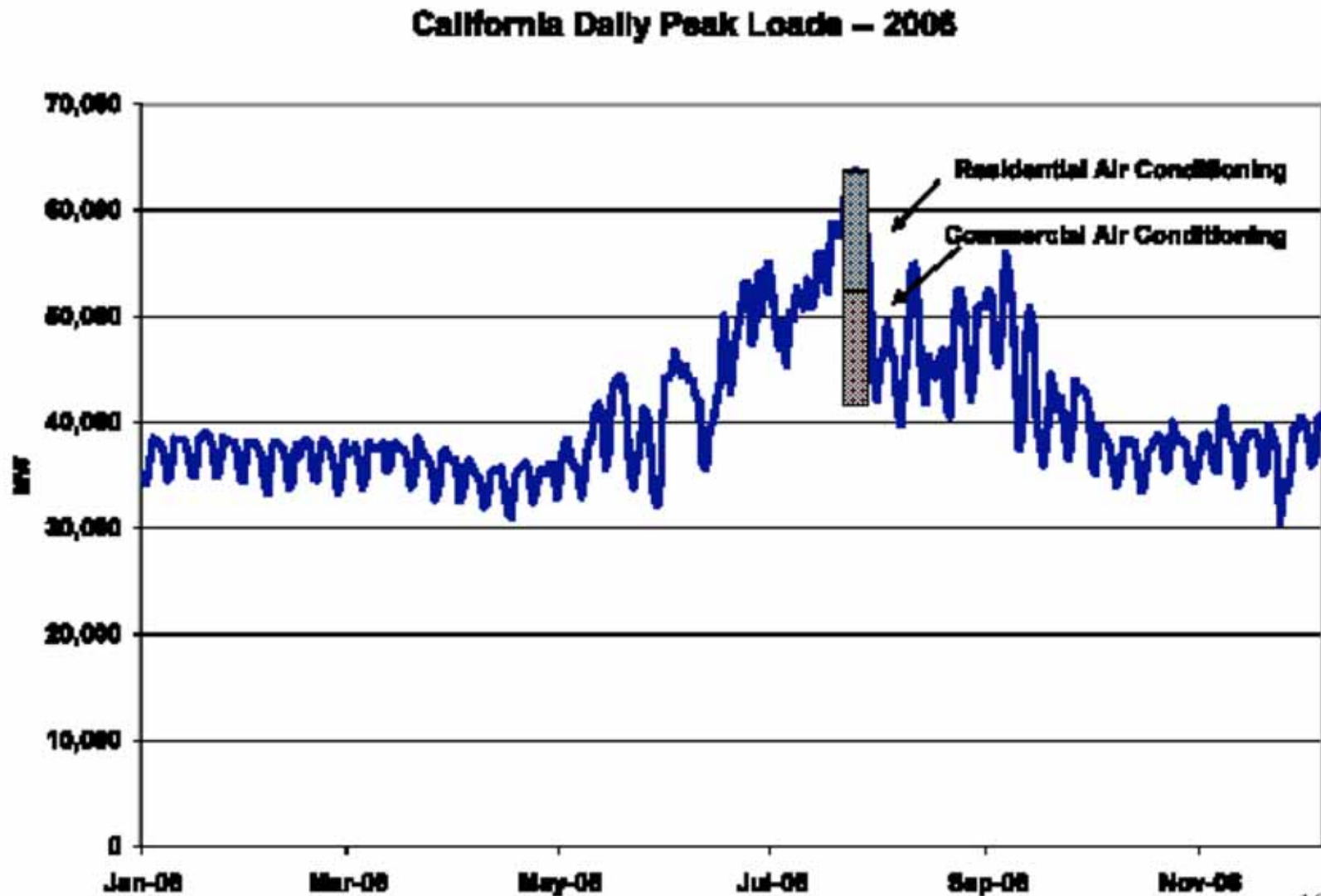
- Programmable communicating thermostats and controls.

Cost premiums are small: \$20-30 for meters, \$20-30 for thermostats

TOU and dynamic pricing will change the design of buildings – promote thermal storage and the use of thermal mass, white roofs, etc.

If you announce dynamic prices today, architects will design better buildings tomorrow.

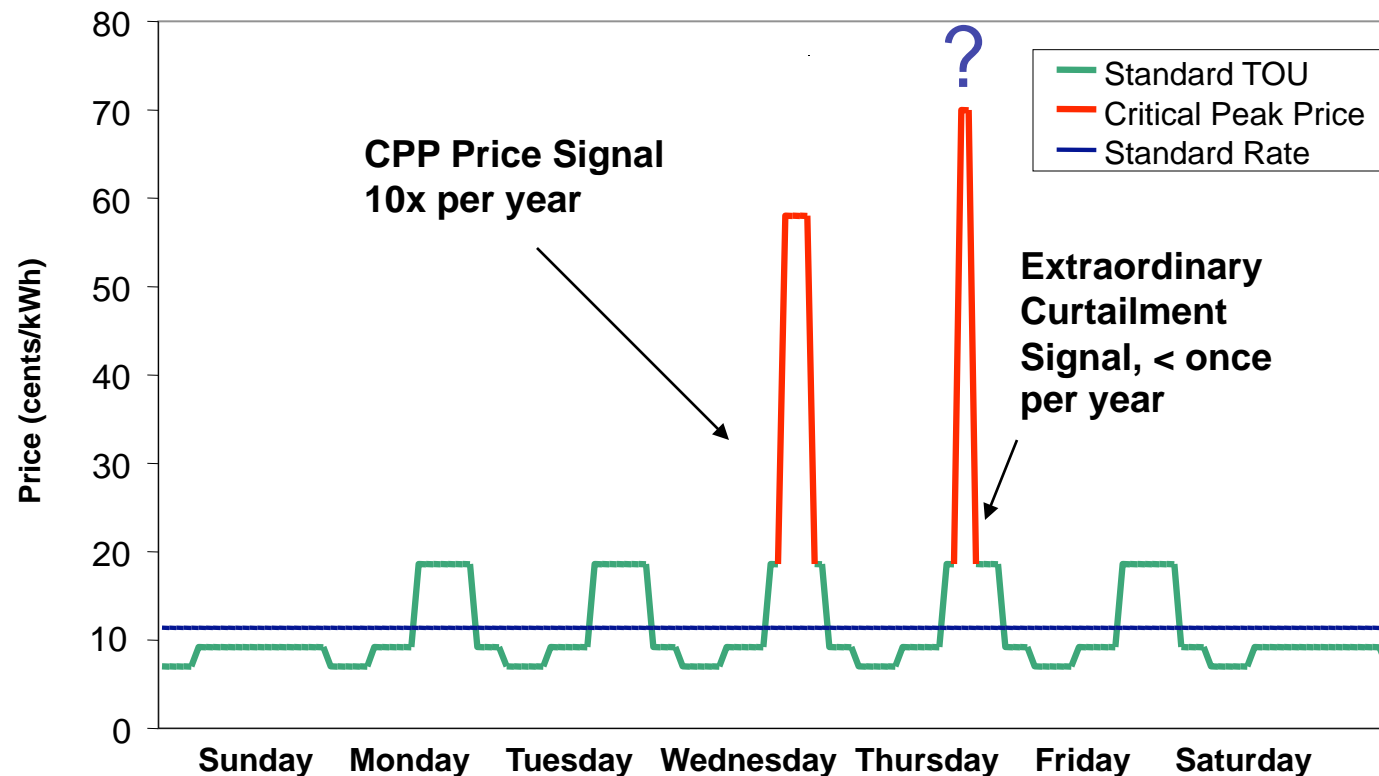
California is VERY MUCH a Summer Peaking Area

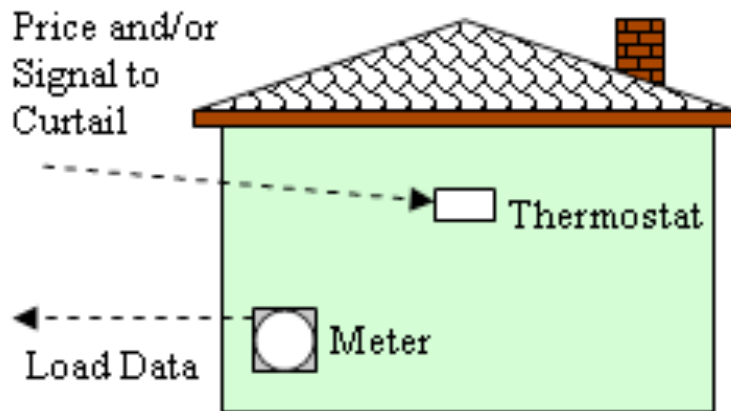


Critical Peak Pricing (CPP) with additional curtailment option

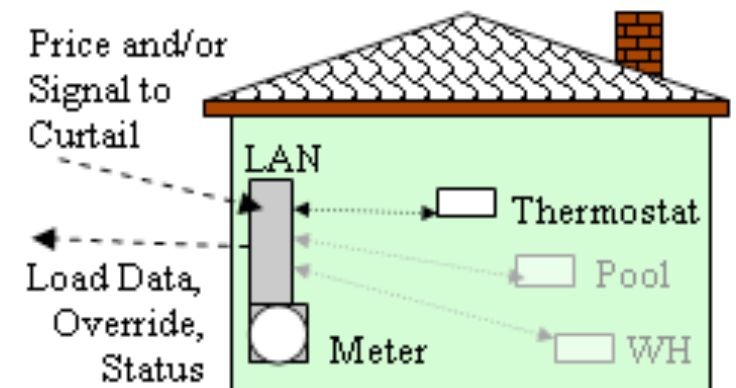
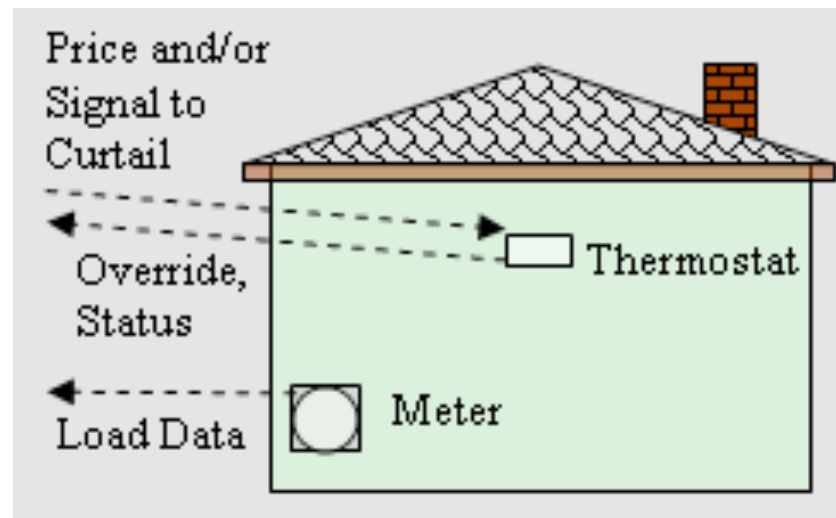
Potential Annual Customer Savings:

10 afternoons x 4 hours x 1kw = 40 kWh at 70 cents/kWh = ~\$30/year

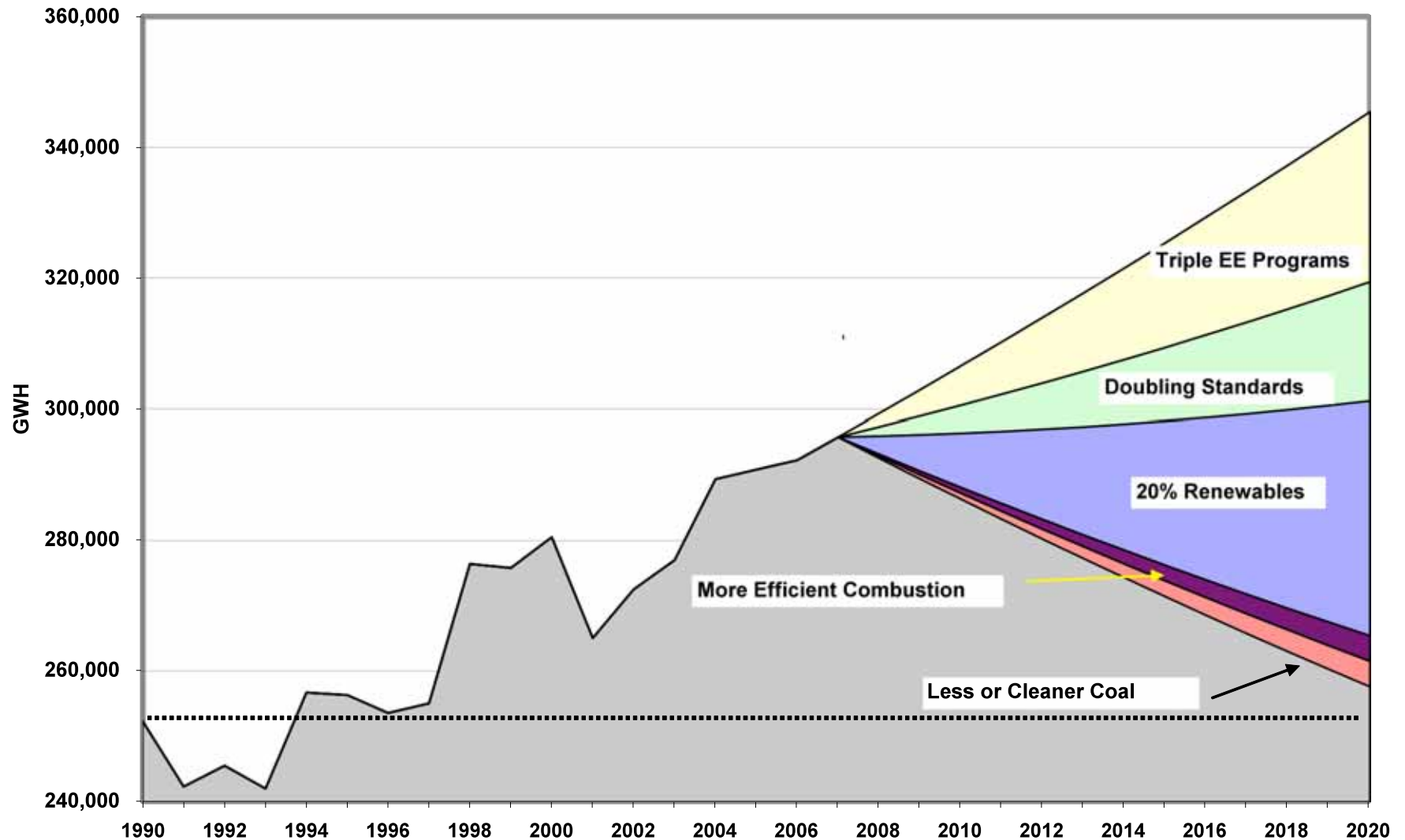




Just some of the proposed systems for PCTs and demand response in the residential and small commercial/industrial sectors.

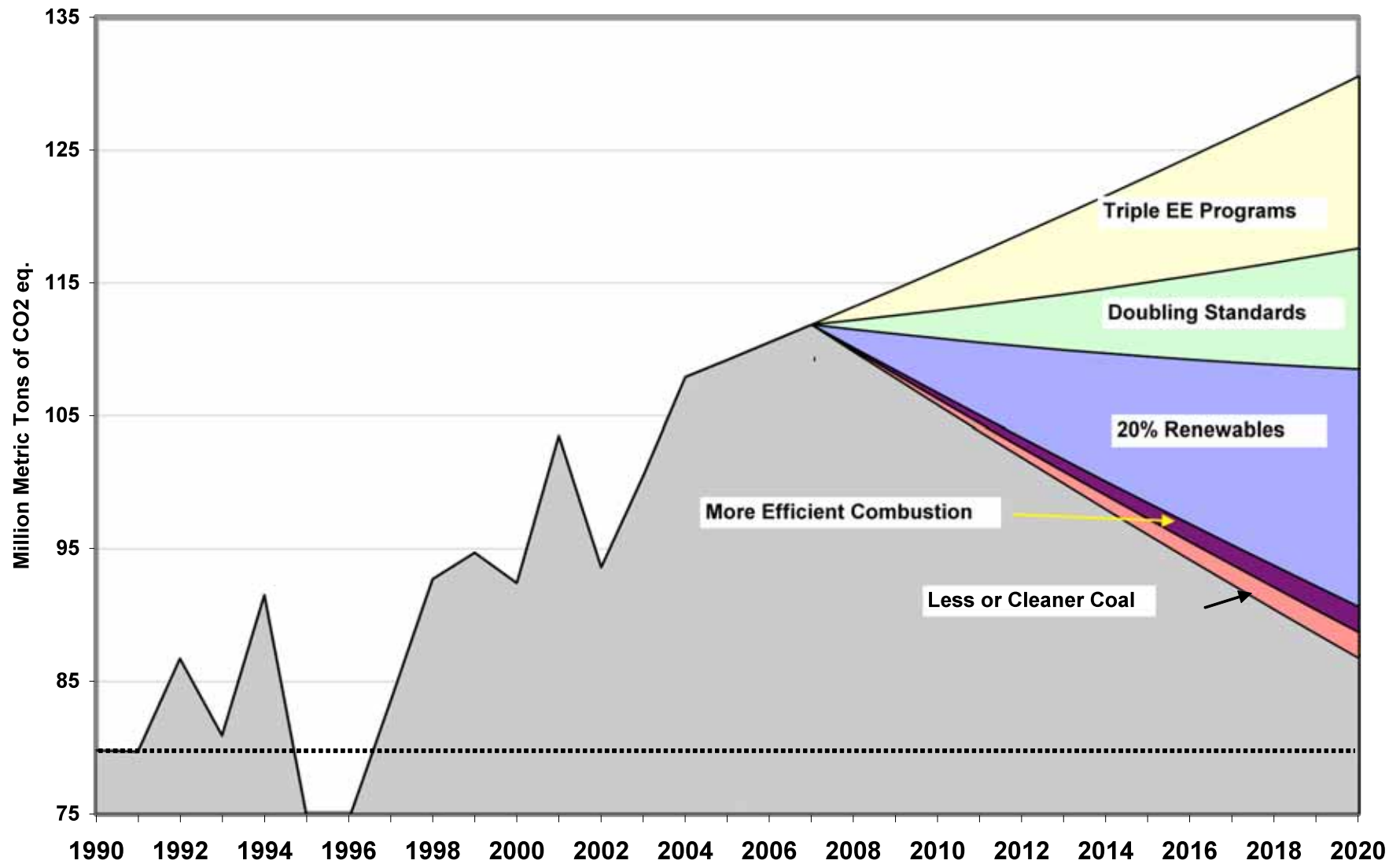


**Possible Strategies to Reduce Electricity Sector Carbon Emissions in California, ignoring
ramp up times and other implementation issues -- The ELECTRICITY Perspective**



Source: Pat McAuliffe, pmcaulif@energy.state.ca.us

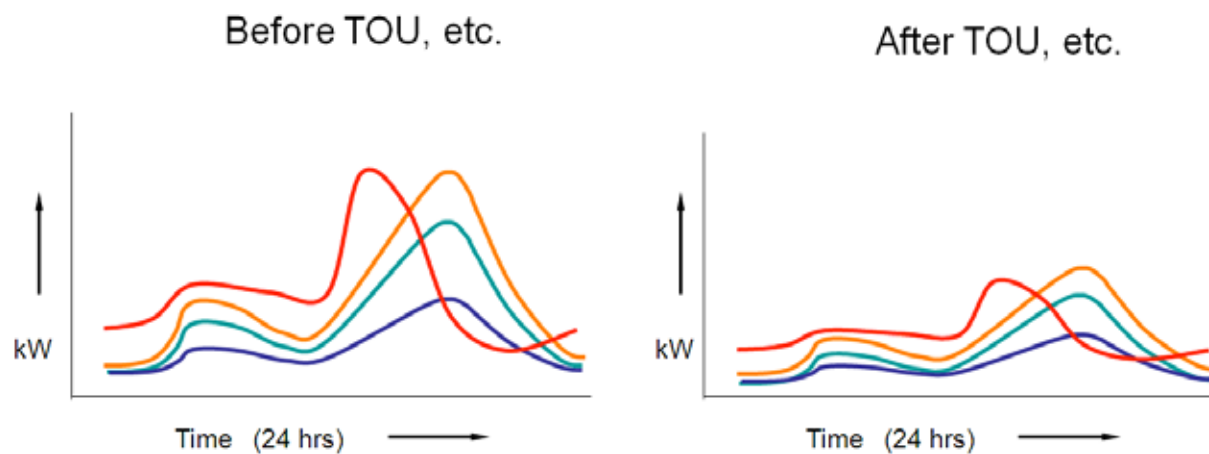
**Possible Strategies to Reduce Electricity Sector Carbon Emissions in California, ignoring
ramp up times and other implementation issues -- The CARBON Perspective**



Source: Pat McAuliffe, pmcaulif@energy.state.ca.us

Load Management Standards

“Cost effective programs that result in improved utility system efficiency, reduced need for new electricity generation, reduced fuel consumption, and **lower long-term economic and environmental costs.**”



Current LMS Proceeding (08-DR-01)

- Assess which rates, tariffs, equipment, software, protocols, and other measures would be most effective in achieving demand response, and
- Adopt regulations and take other appropriate actions to achieve a price responsive electricity market.

Proceeding History (08-DR-01)

- IEPR 2007: Proceeding Recommendation
 - Coordinated with CPUC & ISO
- January 2008: OII/IOR 08-DR-01
- March 2 – July 10, 2008: LMS Workshops
 - Scoping, Smart Grid, Advanced Metering Infrastructure, Rates, Technology, and Education
- November 2008: Draft Proposed LMS
- December 10, 2008: Draft LMS Workshop
- January 2009: All Comments in on Draft
- January – March 2009: Stakeholder Meetings



Successful Statewide DR Requires:

- Advanced Metering Infrastructure (AMI)
- Time-Varying and Dynamic Rates
- Information Model
- Common Signaling Infrastructure (CSI)
- Programmable Communicating Devices (PCDs)

“Programs” vs. Direct Demand Response

- Historically, utilities have offered special programs geared toward direct control of loads
- Direct Demand Response takes place without the need to sign up for any special program

Load Management Standards Guidelines

1. Customers should determine which loads are shed first
2. Demand Response capability should be available to every customer in the state
3. Customers should not have to participate in utility DR **programs**
4. Standards should not hinder customer participation in utility DR **programs**

Load Management Standards Guidelines (con't)

5. Standards should leverage market forces and economies of scale
6. Standards should be technology neutral
7. Standards should set minimum technology functional requirements; e.g. an expansion port on every appliance or an override button for thermostats
8. Customers should have no-cost access to “near-real time” information

Proposed Load Management Standards

- **LMS -1: Advanced Metering Infrastructure (AMI) Schedule**
 - **Purpose:** To require all utilities to prepare a plan for deploying advanced meters to all customers within their service territory.
- **LMS-2: Dynamic Electricity Rates**
 - **Purpose:** To require utilities to develop and offer rate designs that support the state's objectives of providing cost-based price signals.

Proposed Load Management Standards

- **LMS-3: Statewide Time-Differentiated Rate Broadcast**
 - **Purpose:** To establish a standard method for transmitting current rate and reliability information to customers.
- **LMS-4: Home Energy Rating System Information**
 - **Purpose:** To require utilities to provide their customers with information about the Home Energy Rating System, designed to promote the use of in-home energy audits and subsequent cost effective energy efficiency improvements.

Proposed Load Management Standards

- **LMS-5: Existing Building Peak Energy Efficiency Improvements**
 - **Purpose:** To require utilities to develop and expand programs to encourage cost effective energy efficiency improvements in existing building stock within their service territory.
- **LMS-6: Programmable Communicating Device (PCD) Program**
 - **Purpose:** To require utilities to offer a discounted programmable communicating devices (PCD's) to customers equipped with advanced meters.

Proposed Load Management Standards

- **LMS-7: Customer Access to Meter Data**
 - **Purpose:** To ensure customers have access to information related to their energy usage on a “near real time” basis.

LMS Will Spur Innovation

- Goal #1: Actionable information from interval meters should be available on any display device from any physical channel and device, e.g., via cell phones, broadcast digital radio (RDS) and TV (DTV), the Internet, etc.
- Goal #2: Time-differentiated energy prices create a need for products that automatically act as an energy management proxy to meet individual consumer preferences.

LMS Will Spur Innovation

- Goal #3: Traditional consumer devices such as thermostats and appliances will need to “hear” price and grid-event information from utilities and third parties through a variety of physical channels and merge that information with consumer preferences, local weather, existing personal schedules, existing sensors from security & other systems that may come from local sources, from the web, and will be continuously changing.

LMS Will Spur Innovation

- Goal #4: Appliances, thermostats, etc., can't be stranded as technology changes. Simple pathways must be found to upgrade these devices through low-technology actions such as the standard information port being promoted by the U-SNAP Alliance.
- <http://www.usnap.org/U-SNAPOverview.pdf>

U-SNAP Alliance



LMS Will Spur Innovation

- Goal#5: Appliances, thermostats, etc., must be able to move to new locations with their owners and still receive price and event information from their new utility and/or third-party providers (Common Information Model).
- Goal #6: Time-differentiated prices will create a need for products that automatically act as energy management proxies for consumers.

Wireless Can Help

- Energy-related communications installations must be simple, low cost & low-energy/power
 - Ad hoc self-organizing networks (no manuals)
 - Energy/power scavenged from environment
- Must interface & leverage legacy networks, e.g., security, entertainment, home LAN, ...
- Must facilitate “operational efficiency” through the seamless exchange of information from all local and global network resources